A9.6:116/cont.+ind.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ENTOMOLOGY—BULLETIN No. 116.

L. O. HOWARD, Entomologist and Chief of Bureau.

PAPERS ON DECIDUOUS FRUIT INSECTS AND INSECTICIDES.

CONTENTS AND INDEX.

Issued January 18, 1915.

UNIV. OF FL LIB.
DOCUMENTS DEPT.
U.S. DEPOSITORY

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1915.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY—BULLETIN No. 116.
L. O. HOWARD, Entomologist and Chief of Bureau.

PAPERS ON DECIDUOUS FRUIT INSECTS AND INSECTICIDES.

I. SPRAYING EXPERIMENTS AGAINST THE GRAPE LEAFHOPPER IN THE LAKE ERIE VALLEY IN 1911.

By FRED JOHNSON, *Agent and Expert.*

II. THE GRAPE-BERRY MOTH.

By FRED JOHNSON and A. G. HAMMAR, *Entomological Assistants.*

III. THE CHERRY FRUIT SAWFLY.

By S. W. FOSTER, *Entomological Assistant.*

IV. LIME-SULPHUR AS A STOMACH POISON FOR INSECTS.

By E. W. SCOTT and E. H. SIEGLER, *Entomological Assistants,*
Deciduous Fruit Insect Investigations.

V. THE FRUIT-TREE LEAF-ROLLER.

By JOHN B. GILL, *Entomological Assistant.*

1862 1889

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1915.

BUREAU OF ENTOMOLOGY.

L. O. Howard, *Entomologist and Chief of Bureau.*
C. L. Marlatt, *Entomologist and Acting Chief in Absence of Chief.*
R. S. Clifton, *Chief Clerk and Executive Assistant.*
F. H. Chittenden, *in charge of truck crop and stored product insect investigations.*
A. D. Hopkins, *in charge of forest insect investigations.*
W. D. Hunter, *in charge of southern field crop insect investigations.*
F. M. Webster, *in charge of cereal and forage insect investigations.*
A. L. Quaintance, *in charge of deciduous fruit insect investigations.*
E. F. Phillips, *in charge of bee culture.*
A. F. Burgess, *in charge of gipsy moth and brown-tail moth investigations.*
Rolla P. Currie, *in charge of editorial work.*
Mabel Colcord, *in charge of library.*

Deciduous Fruit Insect Investigations.

A. L. Quaintance, *In Charge.*

Fred E. Brooks, John B. Gill, R. L. Nougaret, A. C. Baker, R. A. Cushman, J. F. Strauss, W. F. Turner, J. H. Paine, E. H. Siegler, W. B. Wood, F. L. Simanton, E. B. Blakeslee, H. B. Scammell, *entomological assistants.*

E. J. Newcomer, W. M. Davidson, A. J. Ackerman, R. J. Fiske, Dwight Isely, E. W. Geyer, A. I. Fabis, B. R. Leach, H. G. Ingerson, H. K. Plank, *scientific assistants.*

E. W. Scott, W. S. Abbott, J. E. Dudley, Jr., *employed in enforcement of Insecticide Act of 1910.*

CONTENTS.

Page.

Spraying experiments against the grape leafhopper in the Lake Erie Valley in 1911........*Fred Johnson*.. 1
- Introduction........ 1
- Treatment of nymphs of the grape leafhopper with contact sprays........ 1
- Field experiments with tobacco extracts........ 2
- Vineyard experiments in 1911........ 3
- Use of combined contact and poison spray........ 9
- Effect of grape leafhopper control on quality of fruit........ 10
- Conclusion........ 12

The grape-berry moth (*Polychrosis viteana* Clem.), *Fred Johnson and A. G. Hammar*........ 15
- Introduction........ 15
- History........ 17
- Origin and distribution........ 18
- Food plants........ 20
- Occurrence of the grape-berry moth in destructive numbers........ 21
- Habits of the adult or moth........ 22
- Habits and character of injury of the larva........ 23
- Destructiveness of the larva........ 26
- Other insects whose injury to grape berries resembles that caused by the larva of the grape-berry moth........ 26
- Description........ 28
- Seasonal history........ 30
  - Life-history studies in 1909........ 30
    - Spring brood of moths........ 30
      - Time of emergence of spring brood of moths........ 30
      - Oviposition of spring-emerging moths in confinement........ 31
      - Length of life of spring brood of moths........ 32
    - First generation........ 32
      - Incubation period of first-brood eggs........ 32
      - Length of feeding period of first-brood larvæ........ 33
      - Length of pupal stage of first-brood pupæ........ 33
      - Time of emergence of first-brood moths........ 34
      - Oviposition of first-brood moths........ 35
      - Hibernation of first-brood pupæ........ 36
      - Length of life cycle of first generation........ 37
    - Second generation........ 38
      - Incubation period of second-brood eggs........ 38
      - Length of feeding period of second-brood larvæ........ 38
      - Date second-brood larvæ leave fruit........ 39
  - Miscellaneous rearing records for the seasons of 1907 and 1908........ 41
  - Summary of life-history studies of the grape-berry moth........ 44
- Parasitic enemies........ 45
- Degree of vineyard infestation in Erie County, Pa........ 49

The grape-berry moth, etc.—Continued. Page.
- Remedial measures 50
  - The destruction of fallen leaves 50
  - Plowing in late fall or early spring 51
  - Bagging the clusters 52
  - Hand picking infested berries 52
  - Removal of "trimmings" 52
  - Experiments with poison sprays 52
- Recommendations for control 62
- Conclusion 66
- Bibliography 67

The cherry fruit sawfly (*Hoplocampa cookei* [Clarke]) .... *S. W. Foster* .. 73
- Introduction 73
- Seasonal history and habits 74
  - The adult 74
  - The egg 76
  - The larva 77
- Natural enemies 78
- Experiments in control 79

Lime-sulphur as a stomach poison for insects .. *E. W. Scott and E. H. Siegler* .. 81
- Introduction 81
- Conditions of the experiments 81
- Results 83
- Miscellaneous tests 89
- Conclusions 90

The fruit-tree leaf-roller (*Archips argyrospila* Walk.) .... *John B. Gill* .. 91
- Introduction 91
- History 92
- Distribution 93
- Food plants 93
- Character of injury 94
- Description of stages 96
- Life history and habits 97
  - Larval stage 97
  - Pupal stage 98
  - The adult and egg stages 99
  - Summary of life history 101
  - Hibernation 101
- Natural enemies 102
- Methods of control 102
  - Experimental tests for the destruction of the eggs 103
  - Spraying experiments for the destruction of the egg masses 104
  - Spraying experiments against the larvæ 106
  - Light traps 107
  - Conclusions 108
- Recommendations for control 109

Index 111

ILLUSTRATIONS.

PLATES.

Page.

PLATE I. Spraying against the grape leafhopper. Fig. 1.—Rod and single cyclone nozzle used to apply spray to underside of grape foliage. Power supplied by tractor sprayer. Vineyard of Mr. H. H. Harper, North East, Pa. Fig. 2.—Rod carrying two cyclone nozzles used to apply spray to underside of grape foliage. Power supplied by compressed air. Vineyard of Mr. A. I. Loop, North East, Pa.... 4

II. Comparison of sprayed and unsprayed plats. Fig. 1.—Showing condition of vine injured by grape leafhopper in unsprayed plat. Note loss of foliage and also berries from clusters. Vineyard of Mr. W. E. Gray, North East, Pa. Fig. 2.—Showing condition of vine in plat sprayed with tobacco extract No. 1 against grape leafhopper. Note larger size of berries in clusters, heavy foliage, and stronger cane growth. Vineyard of Mr. W. E. Gray, North East, Pa.... 8

III. Spraying against the grape leafhopper. Fig. 1.—Gasoline engine sprayer supplying power for two "trailer" leads of hose in spraying against grape leafhopper. Vineyard of Mr. J. E. Beatty, North East, Pa. Fig. 2.—Gasoline-engine sprayer supplying power for two "trailer" leads of hose in spraying against grape leafhopper. Vineyard of Peacock-Rood Co., Westfield, N. Y.... 8

IV. The grape-berry moth (*Polychrosis viteana*). Figs. 1, 2.—Adult or moth. Fig. 3.—Full-grown larvæ. Fig. 4.—Pupæ.... 16

V. Injury to grapes by larvæ of first brood of the grape-berry moth. Fig. 1.—Showing destruction of portion of grape cluster as a result of boring of larva into stem. Fig. 2.—Showing cracking of infested berries and also the way in which berries first attacked are secured by web to berries which are attacked later in the development of the larva.... 24

VI. Injury to grapes by larvæ of second brood of the grape-berry moth. Fig. 1.—Showing clusters of Concord grapes from which infested berries have been removed. Fig. 2.—Injury to berries by larvæ just previous to harvesting of fruit.... 24

VII. Outdoor rearing shelter and cage used in life-history studies at North East, Pa. Fig. 1.—Portion of outdoor shelter used in the rearing of insects during 1909. Fig. 2.—Cage built over grapevines in which the generations of the grape-berry moth were reared during 1909.. 32

VIII. Spraying against the grape-berry moth. Fig. 1.—Showing size of grape berries at second spray application about the time many of the first-brood eggs of the grape-berry moth are deposited on them. Fig. 2.—Trailer method of vineyard spraying in order to apply the spray to the underside of the foliage or to the grape clusters where the foliage is dense.... 60

IX. Fig. 1.—Cherries injured by the cherry fruit sawfly (*Hoplocampa cookei*). Fig. 2.—Entrance and exit holes of the cherry fruit sawfly.... 76

Page.

PLATE X. Fig. 1.—Cherry blossom clusters at stage of development when most of the eggs of the cherry fruit sawfly are being deposited. Fig. 2.—Larvæ and cocoons of the cherry fruit sawfly.................. 76

XI. Fig. 1.—Sprayed twig of wild cherry showing larvæ of the fall webworm (*Hyphantria cunea*) feeding on leaves; at right, same, covered with paper bag, to prevent escape of larvæ. Fig. 2.—Unsprayed twig of wild cherry upon which fall webworms have been feeding for some time; for comparison with sprayed twig................ 84

XII. Stages and work of the fruit-tree leaf-roller (*Archips argyrospila*). Fig. 1.—Hatched egg masses on apple twigs. Fig. 2.—Full grown larva. Fig. 3.—Pupæ. Fig. 4.—Cocoon and pupal case. Fig. 5.—Young apples injured by larvæ................................ 94

XIII. Work of the fruit-tree leaf-roller. Fig. 1.—Apple branch, showing webbing and injury to foliage by larvæ. Fig. 2.—Apples injured by larvæ.. 94

XIV. Apple orchard at Canon City, Colo., defoliated by the fruit-tree leaf-roller.. 94

XV. Excessive webbing by larvæ of the fruit-tree leaf-roller............ 94

XVI. Stages of the fruit-tree leaf-roller. Fig. 1.—Egg masses on trunk of apple tree. Fig. 2.—Moth and extruded pupal case. Fig. 3.—Unhatched egg masses on apple twigs................................ 98

TEXT FIGURES.

FIG. 1. The grape leafhopper (*Typhlocyba comes* var. *coloradensis*): Adult...... 1
2. The grape leafhopper: Nymph of the first stage........................ 2
3. The grape leafhopper: Fully developed nymph of the fifth stage...... 2
4. Map showing distribution of the grape-berry moth (*Polychrosis viteana*).. 20
5. Injury to grape cluster by larva of grape-berry moth during and just after the blooming period.................................... 24
6. Pupal cases made on grape leaf by full-grown larvæ of the first brood of the grape-berry moth.. 24
7. Cluster of Concord grapes on which many second-brood eggs of the grape-berry moth are present.. 25
8. The grape curculio (*Craponius inæqualis*): Adult, larva, pupa........ 26
9. Work of the grape curculio in berry of grape.......................... 27
10. Diagram showing time of emergence of spring-brood moths of the grape-berry moth in 1909 at North East, Pa.............................. 30
11. Diagram showing time of emergence of the first-brood moths of the grape-berry moth in 1909 at North East, Pa.............................. 35
12. Diagram showing time of leaving the grape berries by second-brood larvæ of the grape-berry moth, from fruit collected in the field, North East, Pa., 1909.. 40
13. Diagram showing time of emergence of the first-brood moths of the grape-berry moth in 1907 at North East, Pa.............................. 42
14. Diagram showing time of emergence of the spring-brood moths of the grape-berry moth in 1908 at North East, Pa.......................... 43
15. Seasonal history of the grape-berry moth as observed in 1909 at North East, Pa.. 45
16. *Thymaris slingerlandana*, a common parasite of the grape-berry moth... 46
17. Vineyard in which poison-spray experiments were conducted against larvæ of the grape-berry moth during the seasons of 1907, 1908, and 1909; vineyard of Mr. W. S. Wheeler, North East, Pa................ 53

Page

FIG. 18. Plat arrangement of poison-spraying experiments against the larvæ of the grape-berry moth in the vineyard of Mr. W. S. Wheeler, North East, Pa., 1907 53
19. Gasoline-engine sprayer outfit used in vineyard experiments against the larvæ of the grape-berry moth in vineyard of Mr. W. S. Wheeler, North East, Pa., 1907, 1903, 1909 54
20. Stage of development of grape blossom cluster at which poison-spray application should be made against early hatching larvæ of the grape-berry moth which infest the blossom clusters.... 55
21. Plat arrangement of poison-spraying experiments against the grape-berry moth in the vineyard of Mr. W. S. Wheeler, North East, Pa., 1908 and 1909.... 57
22. Overwintering cocoons of the grape-berry moth upon leaf on ground, beneath a badly infested grapevine.... 66
23. The cherry fruit sawfly (*Hoplocampa cookei*): Egg, larvæ, adult and details, work.... 75
24. *Microbracon* sp., a hymenopterous parasite of the cherry fruit sawfly... 78

INDEX.

Page.

- *Agelaius phœniceus phœniceus*, enemy of *Archips argyrospila* 102
- Alfalfa, food plant of *Archips argyrospila* 94
- *Ambrosia trifida*, reported food plant of *Polychrosis viteana* 21
- *Ameloctonus* sp., parasite of *Polychrosis viteana* 48
- Amorpha stems, reported food of *Polychrosis viteana* 20
- *Apanteles canarsiæ*, parasite of *Polychrosis viteana* 47
  - *Canarsia hammondi* 47
  - sp., parasite of *Polychrosis viteana* 48
- Apple, food plant of *Archips argyrospila* 92, 93
- Apricot, food plant of *Archips argyrospila* 93
- *Archips argyrospila* 91–110
  - adult, description 96
    - life history and habits 99–101
  - control experiments, conclusions 108–109
    - methods 102–109
    - recommendations 109–110
  - damage caused in Missouri 92
  - description of stages 96–97
  - distribution 93
  - egg, description 96
    - life history 99–101
  - eggs, experiments for destruction 103–105
  - enemies 102
  - food plants 93–94
  - habits 97–102
  - hibernation 101–102
  - history 92–93
  - injury, character 94–95
  - in New York in 1911, Herrick's description 91
  - larva, description 96
    - life history and habits 97–98
  - life history 97–102
    - summary 101
  - outbreaks in Southwest 91
  - pupa, description 97
    - life history 98–99
- Arsenate of lead against cherry fruit sawfly 79
  - fall webworm as compared with lime-sulphur 84–88
  - fruit-tree leaf-roller 106–107
  - grape-berry moth 9–10
  - grape rootworm 9–10
  - and Bordeaux mixture against grape insects 5
    - grape-berry moth 54–67
  - lime-sulphur against fall webworm 83, 85, 87
  - nicotine solution against fruit-tree leaf-roller 106–107
  - Paris green against fruit-tree leaf-roller 106–107

Page.
Arsenate of lead, Bordeaux mixture, and tobacco extract against grape leafhopper and other grape insects and fungous diseases ... 9–10
resin fish-oil soap, and Bordeaux mixture against grape-berry moth ... 54–59
zinc against fruit-tree leaf-roller ... 106–107
Arsenite of lime and Bordeaux mixture against grape-berry moth ... 54–57
burning of grape foliage from use with tobacco extract ... 10
resin fish-oil soap, and Bordeaux mixture against grape-berry moth ... 54–57
Ascogaster carpocapsæ, parasite of *Carpocapsa pomonella* ... 48
Polychrosis viteana ... 48
Ash, food plant of *Archips argyrospila* ... 92, 93
Aspidiotus howardi, miscible oils in control ... 110
perniciosus, miscible oils in control ... 110
Bagging the clusters against grape-berry moth ... 52
Basswood, food plant of *Archips argyrospila* ... 94
Bathymetis sp., near *terminalis*, parasite of *Polychrosis viteana* ... 46
Beans, food plants of *Archips argyrospila* ... 94
Blackberry blossoms, reported food of *Polychrosis viteana* ... 20
food plant of *Archips argyrospila* ... 94
Blackbird, red-winged. (See *Agelaius phœniceus phœniceus*.)
Bluebird. (See *Sialia sialis*.)
Boneset, reported food plant of *Polychrosis viteana* ... 21
Bordeaux mixture against fall webworm ... 89
grape mildew ... 9–10
and arsenate of lead against grape-berry moth ... 54–67
grape insects ... 5
arsenite of lime against grape-berry moth ... 54–57
arsenate of lead, and tobacco extract against grape leafhopper and other grape insects and fungous diseases ... 9–10
fish-oil soap, and tobacco extract against grape leafhopper and other grape insects and fungous diseases ... 9–10
resin fish-oil soap, and arsenate of lead against grape-berry moth ... 54–59
arsenite of lime against grape-berry moth ... 54–57
Box-elder, food plant of *Archips argyrospila* ... 93
Bracon scrutator, parasite of *Polychrosis viteana* ... 46
Calosoma scrutator, enemy of *Archips argyrospila* ... 102
Canarsia hammondi, host of *Apanteles canarsiæ* ... 47
Carpocapsa pomonella, host of *Ascogaster carpocapsæ* ... 48
lime-sulphur as a stomach poison ... 89
vitisella, bibliographic reference ... 68
=*Polychrosis viteana* ... 18, 29
Catbird. (See *Dumetella carolinensis*.)
Cedar, food plant of *Archips argyrospila* ... 94
Cherry, food plant of *Archips argyrospila* ... 92, 93
fruit sawfly. (See *Hoplocampa cookei*.)
wild, food plant of *Archips argyrospila* ... 93
black. (See *Prunus serotina*.)
Clean culture against grape-berry moth ... 50–51
Clover, red, food plant of *Archips argyrospila* ... 94
Codling moth. (See *Carpocapsa pomonella*.)

Page.

- Copper sulphate against grape mildew ... 5
- Cottonwood, food plant of *Archips argyrospila* ... 94
- *Craponius inæqualis*, similarity of injury to that of *Polychrosis viteana* ... 16, 26–27
- Cultural methods against cherry fruit sawfly ... 79
- Currant, food plant of *Archips argyrospila* ... 93
- *Dioctes obliteratus*, parasite of *Gelechia rubidella* ... 48
    - *Polychrosis viteana* ... 48
- Distillate-oil emulsion against fruit-tree leaf-roller eggs ... 103
    - and nicotine sulphate against cherry fruit sawfly ... 79
- *Dolerus cookei*=*Hoplocampa cookei* ... 73
- *Dumetella carolinensis*, enemy of *Archips argyrospila* ... 102
- Elm, food plant of *Archips argyrospila* ... 93
- *Endopiza? viteana*=*Polychrosis viteana* ... 18, 29
- *Epiurus indagator*, parasite of *Archips argyrospila* ... 102
    - var. *nigrifrons* parasite of *Polychrosis viteana* ... 48
- *Eriocampoides cerasi*, sulphur as a stomach poison ... 88–89
- *Erythræus* sp., enemy of *Archips argyrospila* ... 102
- *Eudemis botrana*, biographical references ... 68–70
    - name wrongly applied to *Polychrosis viteana* ... 15, 18
- *Evoxysoma vitis*, resemblance of injury to that of grape-berry moth ... 27–28
- *Exorista blanda*, parasite of *Archips argyrospila* ... 102
    - *cheloniæ*, parasite of *Archips argyrospila* ... 102
    - *nigripalpis*, parasite of *Archips argyrospila* ... 102
    - *pyste*, parasite of *Archips argyrospila* ... 102
- Fish-oil soap and lime-sulphur against codling moth ... 89
- *Formica montanus*, enemy of *Archips argyrospila* ... 102
- Foster, S. W., paper, "The Cherry Fruit Sawfly (*Hopocampa cookei* [Clarke])" . 73–79
- *Gelechia rubidella*, host of *Dioctes obliteratus* ... 48
- *Gelechia* sp., host of *Glypta vulgaris* ... 46
- Gill, John B., paper, "The Fruit-Tree Leaf-Roller (*Archips argyrospila* Walk.)" 91–110
- *Glypta animosa*, hosts ... 46
    - parasite of *Polychrosis viteana* ... 47
    - *vulgaris*, hosts ... 46
        - parasite of *Polychrosis viteana* ... 46
- Gooseberry, food plant of *Archips argyrospila* ... 93
- Grape, food plant of *Archips argyrospila* ... 94
    - berries, food of *Endospiza* (?) *viteana* ... 18
    - blossoms, food plant of *Polychrosis viteana* ... 21
    - curculio. (See *Craponius inæqualis.*)
    - quality of fruit affected by grape leafhopper control ... 10–12
    - rootworm, control by arsenate of lead ... 9–10
    - tendrils, food of *Polychrosis viteana* ... 21
- Grapes, increased yield produced by spraying for grape leafhopper ... 4–9
    - wild, food of *Polychrosis viteana* ... 21
- Hammar, A. G., Fred Johnson and, paper, "The Grape-Berry Moth (*Polychrosis viteana* Clem.)" ... 15–71
- Hand picking berries against grape-berry moth ... 52
- Hazelnut, food plant of *Archips argyrospila* ... 94
- Hickory, food plant of *Archips argyrospila* ... 93
- *Hoplocampa californica*=*Hoplocampa cookei* ... 73–74
    - *cookei* ... 73–79
        - adult, habits and seasonal history ... 74–76
        - control experiments ... 79

	Page.
Hoplocampa cookei egg, seasonal history	76–77
enemies	78–79
habits	74–78
larva, habits and seasonal history	77–78
seasonal history	74–78
Hopvines, food plant of *Archips argyrospila*	94
Horse-chestnut, food plant of *Archips argyrospila*	92, 93
Hyphantria cunea, lime-sulphur as a stomach poison	81–83
Ichneumon parasite of *Hoplocampa cookei*	78
Icterus spurius, enemy of *Archips argyrospila*	102
Ironweed, reported food plant of *Polychrosis viteana*	20
Itoplectis conquistor, parasite of *Archips argyrospila*	102
Polychrosis viteana	48
Johnson, Fred, paper "Spraying Experiments against the Grape Leafhopper in the Lake Erie Valley in 1911"	1–13
Johnson, Fred, and Hammar, A. G., paper, "The Grape-Berry Moth (*Polychrosis viteana* Clem.)"	15–71
Kerosene emulsion against fruit-tree leaf-roller eggs	103
and lime-sulphur against codling moth	89
Kingbird. (See *Tyrannus tyrannus.*)	
Leafhopper, grape, control as affecting quality of fruit	10–12
results of spraying against it	12–13
spraying experiments against it in the Lake Erie Valley in 1911, paper	1–13
treatment of nymphs with contact sprays	1–2
use of combined contact and poison spray	9–10
vineyard experiments against it in 1911	3–9
Leaf-roller, fruit-tree. (See *Archips argyrospila.*)	
Light traps against fruit-tree leaf-roller	107–108
Lilac, food plant of *Archips argyrospila*	94
Lime against fall webworm	89
and Paris green against fruit-tree leaf-roller	106–107
sulphur against Howard scale	105
and arsenate of lead against fall webworm	83, 85–87
fish-oil soap against codling moth	89
kerosene emulsion against codling moth	89
as a stomach poison for insects, paper	81–90
commercial, against fruit-tree leaf-roller eggs	103–105
Lobesia botrana, bibliographic reference	68
name wrongly applied to *Polychrosis viteana*	17–18
Locust, honey, food plant of *Archips argyrospila*	93
Magnolia leaves, reported food of *Polychrosis viteana*	21
Maple, food plant of *Archips argyrospila*	92
soft, food plant of *Archips argyrospila*	93
Margaronia quadristigmalis, host of *Glypta vulgaris*	46
Meteorus archipsidis, parasite of *Archips argyrospila*	102
sp., parasite of *Polychrosis viteana*	48
Microbracon dorsator, parasite of *Polychrosis viteana*	48
mellitor, parasite of *Polychrosis viteana*	48
sp., parasite of *Hoplocampa cookei*	78
Mildew of grape, control by Bordeaux mixture	9–10
Nicotine solution and arsenate of lead against fruit-tree leaf-roller	106–107
soap against fruit-tree leaf-roller	106–107

Page.
Nicotine sulphate and distillate-oil emulsion against cherry fruit sawfly 79
Nola sp., host of *Omorgus nolæ* 48
Notoxus monodon, enemy of *Archips argyrospila* 102
Oak, food plant of *Archips argyrospila* 93
Oats, food plant of *Archips argyrospila* 94
Oil, miscible, against fruit-tree leaf-roller eggs 103–105
Oils, miscible, against San Jose scale 110
Omorgus nolæ, parasite of *Nola* sp 48
        Polychrosis viteana 48
Onions, food plant of *Archips argyrospila* 94
Oriole, orchard. (See *Icterus spurius*.)
Orthizema sp., parasite of *Polychrosis viteana* 48
Osage orange, food plant of *Archips argyrospila* 94
Pædisca scudderiana, host of *Glypta animosa* 46
Paris green and arsenate of lead against fruit-tree leaf-roller 106–107
        lime against fruit-tree leaf-roller 106–107
    burning of grape foliage from use with tobacco extract 10
Passer domesticus, enemy of *Archips argyrospila* 102
Peach, food plant of *Archips argyrospila* 93
Pear, food plant of *Archips argyrospila* 93
Pear slug. (See *Eriocampoides cerasi*.)
Peas, food plant of *Archips argyrospila* 94
Penthina vitivorana, bibliographic references 67
        =*Polychrosis viteana* 17, 18, 29
Petroleum, crude, emulsion, against fruit-tree leaf-roller eggs 103
Phœbe. (See *Sayornis phœbe*.)
Phylloxera lice and galls, reported food of *Polychrosis viteana* 21
Phytodietus sp., parasite of *Polychrosis viteana* 48
Pimpla pedalis, parasite of *Archips argyrospila* 102
Planesticus migratorius, enemy of *Archips argyrospila* 102
Plowing in the late fall and early spring against grape-berry moth 51
Plum, food plant of *Archips argyrospila* 93
Polychrosis botrana, bibliographic references 70
    other species confused with *Polychrosis viteana* 15
    viteana 15–71
        adult, description 29
            habits 22–23
        bibliography 67–71
        conclusion 66–67
        control recommendations 62–66
        description 28–29
        destructiveness of larva 26
        distribution 18–20
        egg, description 28
        enemies, parasitic 45–48
        first brood eggs, period of incubation 32–33
            larvæ, feeding period, length 33
            moths, oviposition 35–36
                time of emergence 34–35
            pupæ, hibernation 36–37
                length of stage 33–34
          generation 32–38
        food plants 20–21

Page.
Polychrosis viteana, habits and character of injury of larva 23–25
of adult or moth 22–23
history 17–18
injury of larva, character 23–25
insects whose injury to grape berries is similar thereto 26–28
larva, description 28
destructiveness 26
habits 23–25
injury, character 23–25
life cycle of first generation, length 37–38
history studies in 1909 30–41
summary 44–45
occurrence in destructive numbers 21–22
origin 18–20
pupa, description 29
rearing records, miscellaneous, for 1907 and 1908 41–44
remedies 50–67
seasonal history 30–45
second brood eggs, incubation period 38
larvæ, date of leaving fruit 39–41
feeding period, length 39
generation 38–41
similarity of injury to that of grape curculio (*Craponius inæqualis*) 16
spring brood of moths, length of life 32
oviposition in confinement 31–32
time of emergence 30–31
synonymy 29
vineyard infestation in Erie County, Pa., degree 49–50
Poplar, Carolina, food plant of *Archips argyrospila* 94
Prunus serotina, food plant of *Hyphantria cunea* 81
Pyralid host of *Glypta animosa* 46
Quince, food plant of *Archips argyrospila* 93
Radish, food plant of *Archips argyrospila* 94
Raspberry, food plant of *Archips argyrospila* 93
fruits, wild, food of *Endospiza* (?) *viteana* 18
wild, reported food of *Polychrosis viteana* 20
Resin fish-oil soap, arsenite of lime, and Bordeaux mixture against grape-berry moth 54–57
Bordeaux mixture, and arsenate of lead against grape-berry moth 54–59
Retinia argyrospila=*Archips argyrospila* 92
original description 96
Rhubarb, food plant of *Archips argyrospila* 94
Robin, western. (See *Planesticus migratorius propinquus*.)
Rose, food plant of *Archips argyrospila* 92, 93
Roses, reported food of *Polychrosis viteana* 20
Sassafras, food plant of *Archips argyrospila* 93
Endospiza (?) *viteana* 18
leaves, reported food of *Polychrosis viteana* 20
Sayornis phœbe, enemy of *Archips argyrospila* 102
Scale, Howard. (See *Aspidiotus howardi*.)
San Jose. (See *Aspidiotus perniciosus*.)

Page
Sialia sialis, enemy of *Archips argyrospila* 102
Scott, E. W., and Siegler, E. H., paper, "Lime-Sulphur as a Stomach Poison for Insects" 81–90
Siegler, E. H., and Scott E. W., paper, "Lime-Sulphur as a Stomach Poison for Insects" 81–90
Snowball, food plant of *Archips argyrospila* 94
Soap and nicotine solution against fruit-tree leaf-roller 106–107
  fish-oil, Bordeaux mixture, and tobacco extract against grape-leaf hopper and other grape insects and fungous diseases 9–10
Sparrow, English. (See *Passer domesticus*.)
Sulphur ineffective against fall webworm 89
Sumac seed bunches, reported food of *Polychrosis viteana* 21
Temperature in relation to time of leaving fruit of second-brood larvæ of *Polychrosis viteana* 40–41
Thistle flower buds, reported food of *Polychrosis viteana* 20–21
Thoroughwort. (*See* Boneset.)
Thymaris slingerlandana=*Dioctes obliteratus* 48
  parasite of *Polychrosis viteana* 47
Tobacco extract, Bordeaux mixture, and arsenate of lead against grape leafhopper and other grape insects and fungous diseases 9–10
  fish-oil soap, and Bordeaux mixture against grapeleaf hopper and other grape insects and fungous diseases 9–10
  extracts against grape leafhopper 2–3
Tortricids, hosts of *Glypta animosa* 46
Tortrix furvana=*Archips argyrospila* 92
  v-signatana=*Archips argyrospila* 92
Trichogramma pretiosa, parasite of *Polychrosis viteana* 48
"Trimmings," removal, against grape-berry moth 52
Tulip-tree leaves, reported food of *Polychrosis viteana* 20
Typhlocyba comes. (*See* Leafhopper, grape.)
  var. *coloradensis* (*see also* Leafhopper, grape.)
Tyrannus tyrannus, enemy of *Archips argyrospila* 102
Urogaster canarsiæ=*Apanteles canarsiæ* 47
Vernonia. (*See* Ironweed.)
Virginia creeper, food plant of *Archips argyrospila* 94
Walnut, black, food plant of *Archips argyrospila* 92, 93
Webworm, fall. (See *Hyphantria cunea*.)
Wheat, food plant of *Archips argyrospila* 94
Whitewash against fruit-tree leaf-roller eggs 103

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
5 CENTS PER COPY
▽

UNIVERSITY OF FLORIDA
3 1262 09216 5066